Clothianidin Colony Feeding Study

Study Conclusions

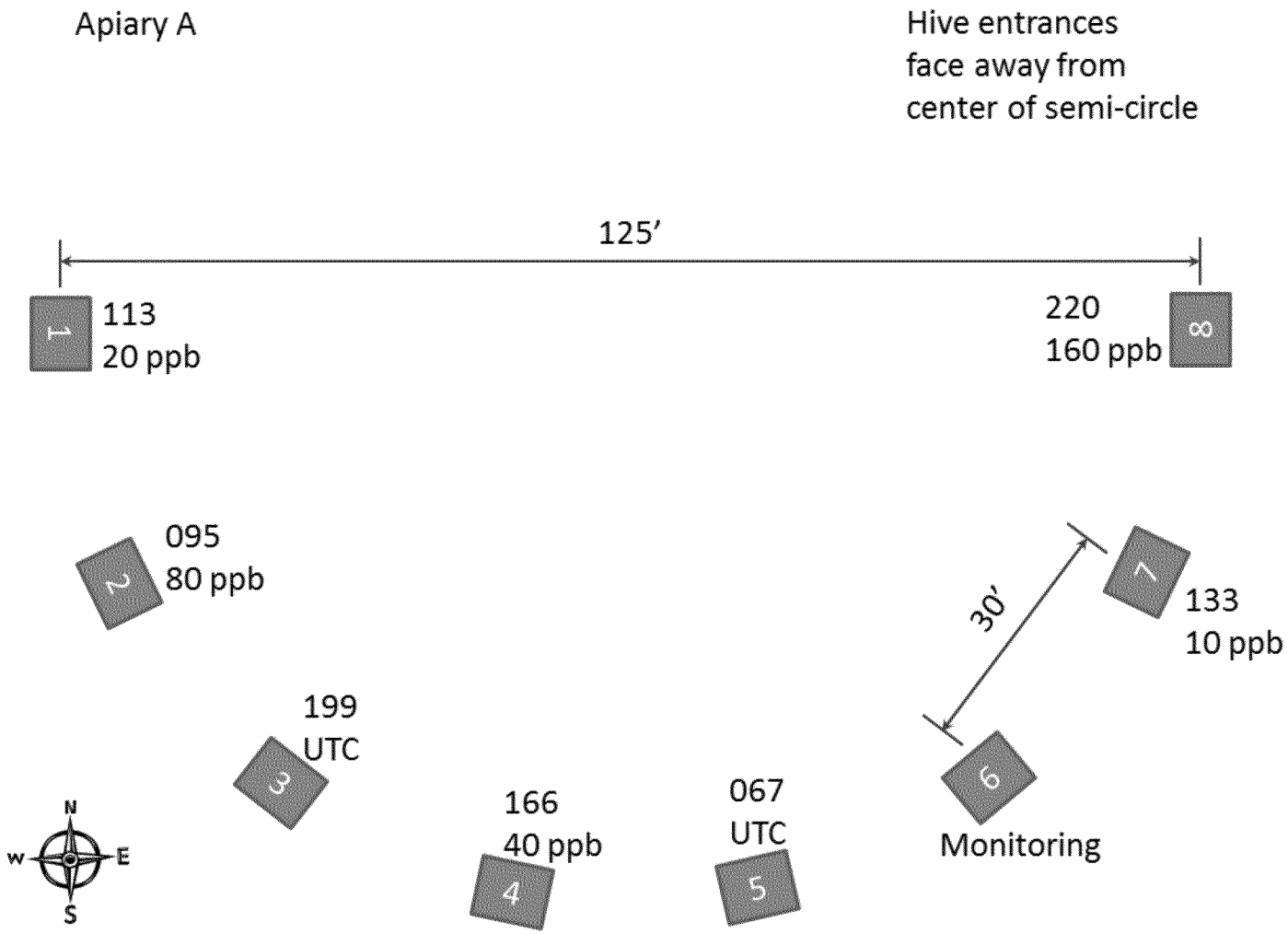
- Overall NOAEC at 20 ppb based on colony condition assessments (pollen, brood, adults)
- Likely increased overwintering losses at 160 ppb. No apparent effect at 80 ppb; however, low survival in controls
- Generally similar pattern of effects with other neonicotinoids

Colony Feeding Study Experimental Design

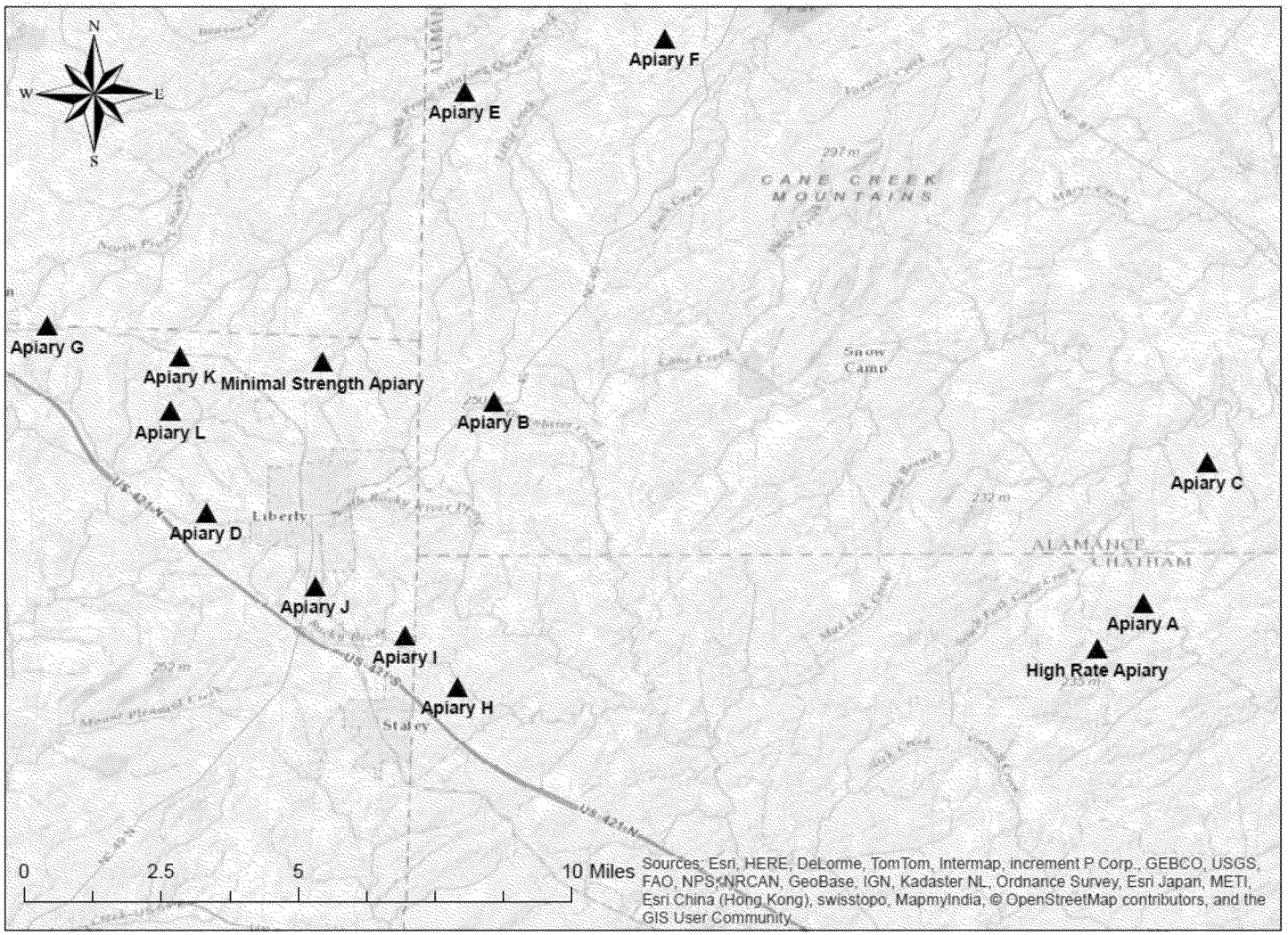
- New colonies initiated with package bees and new hive equipment in the Spring
- Clothianidin exposed to honey bee colonies via sucrose solution placed in hive top feeders
- 2 L of treated solution added to each hive twice a week for six weeks during Summer
- 5 treatment levels: 10, 20, 40, 80, 160 µg/L
- 12 apiary replicates (blocks)
- Each apiary has two control colonies and one colony for each treatment level

Hive top Feeder example (picture not from this study)

Example Apiary Setup



Apiary Locations



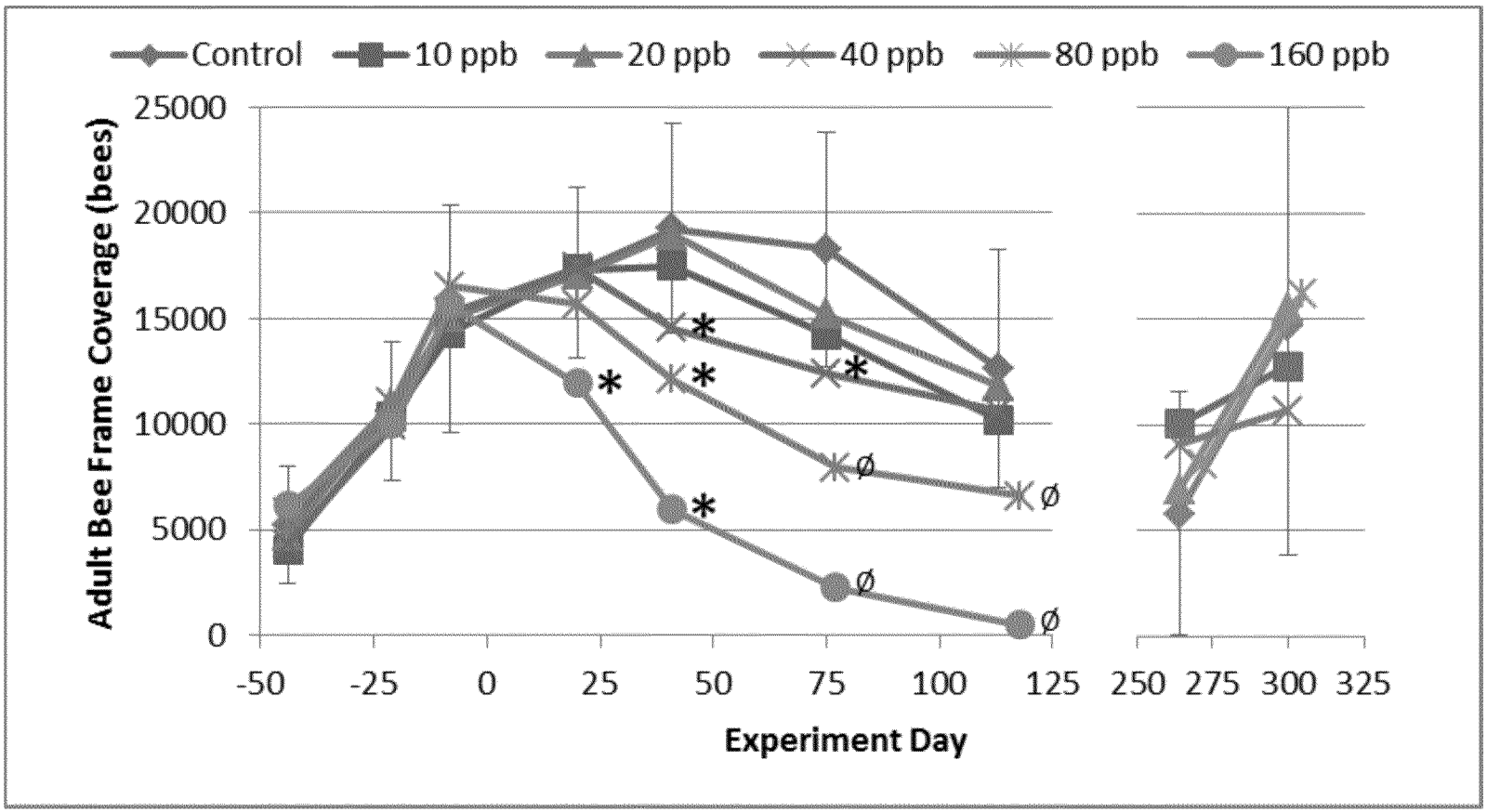
Land Use Pattern Based on 2014 Cropland Data Layer

Land Use Category	Average of 12 Study Apiaries		
	1 mile radius	3 mile radius	5 mile radius
Corn	2.5%	3.1%	2.7%
Soybean	3.3%	4.5%	4.4%
Other Crops	0.9%	0.7%	0.6%
Developed, Open Space	6.0%	5.7%	5.3%
Developed, Low-High Intensity	3.0%	2.7%	2.3%
Forest	44.4%	45.7%	47.8%
Grassland/Pasture/Hay	38.8%	36.1%	35.2%
Water/Barren/Shrub/ Wetland	1.1%	1.5%	1.6%

Monitoring Hive Results

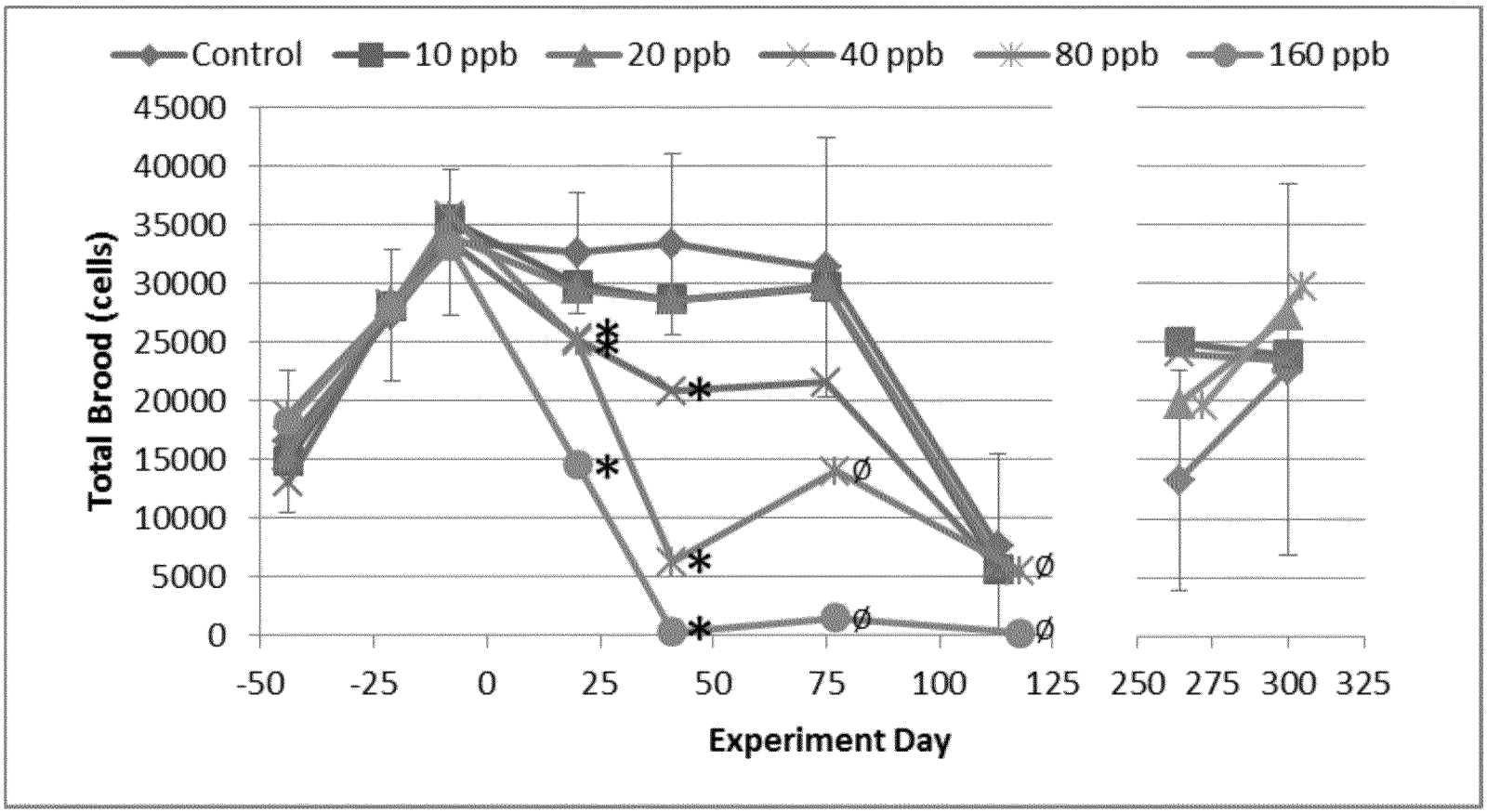
- Pollen ID predominant types: clover, sweetclover, crepe myrtle, plantain, Vitis, magnolia, corn, Virginia creeper, Amaranth, asters
- Pollen residues (n=42):
  - 203 ppb clorothalonil (Jul 1)
  - 119 ppb carbaryl (Aug 13)
  - 2010 ppb propiconazole (Oct 20)
- Nectar residues (n=59): none detected

Adult Bee Frame Coverage



* statistically significantly lower than in the control group, Ø not included in statistical analysis

Total Brood



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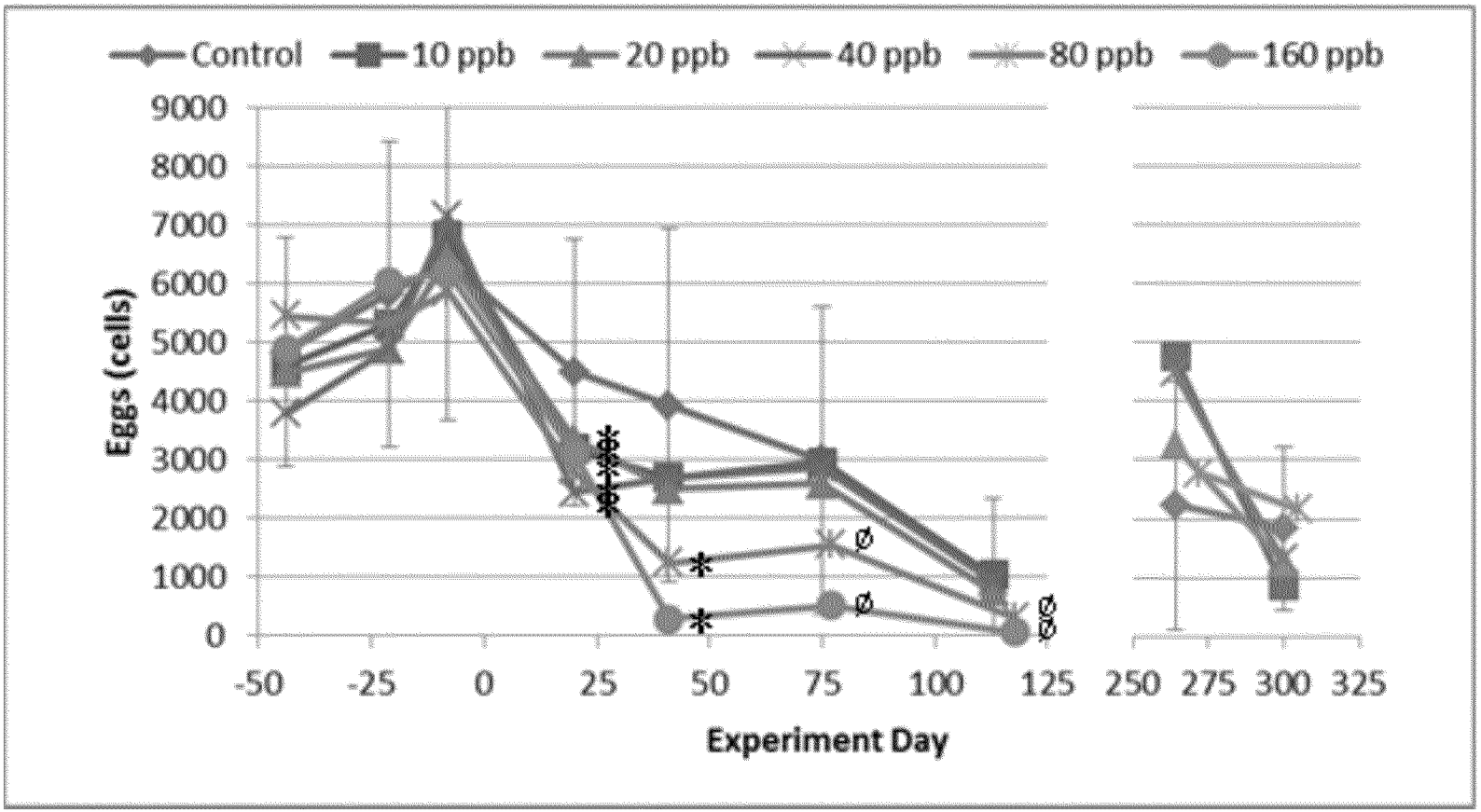
Eggs



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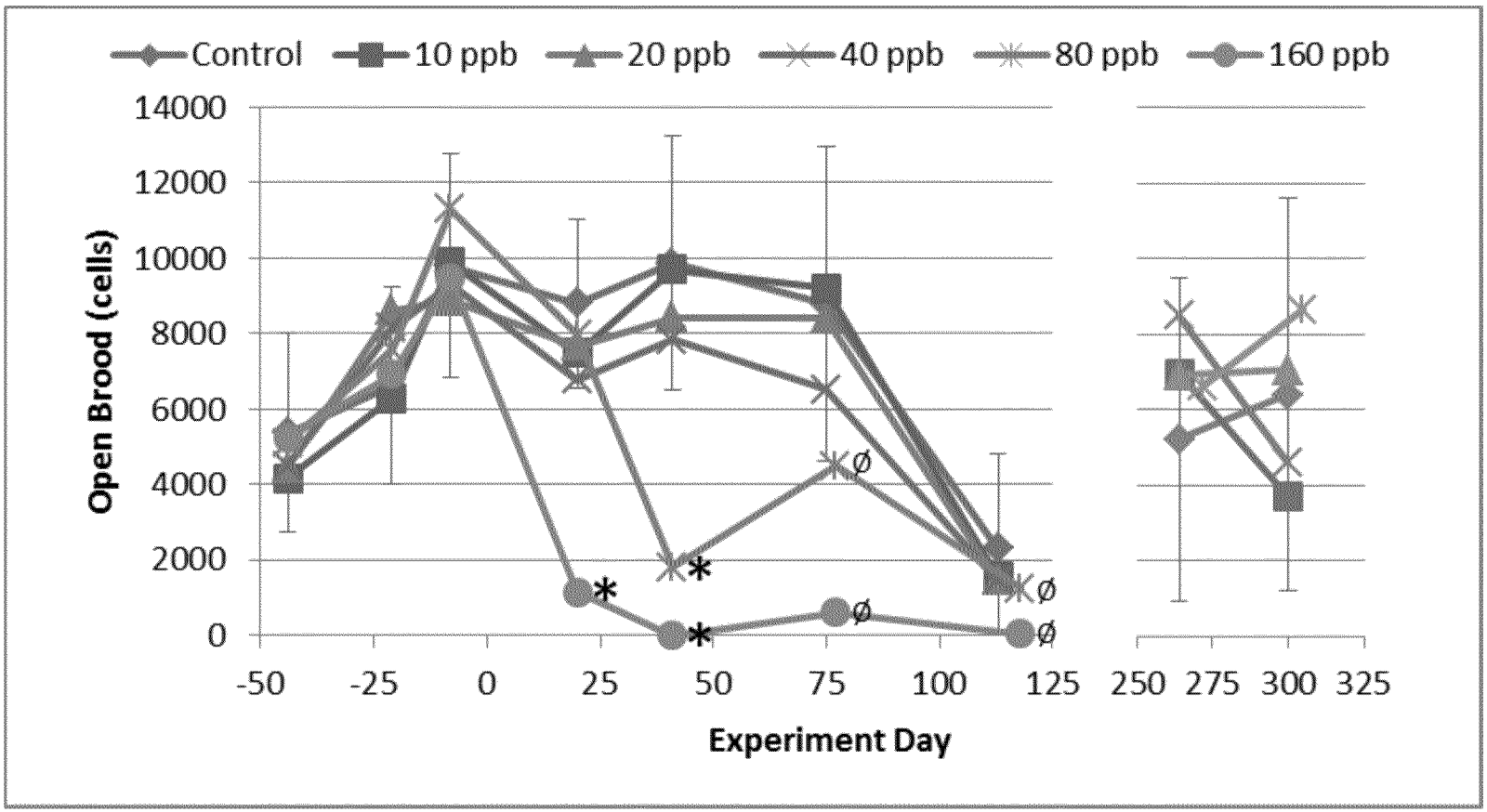
Open Brood (Larvae)



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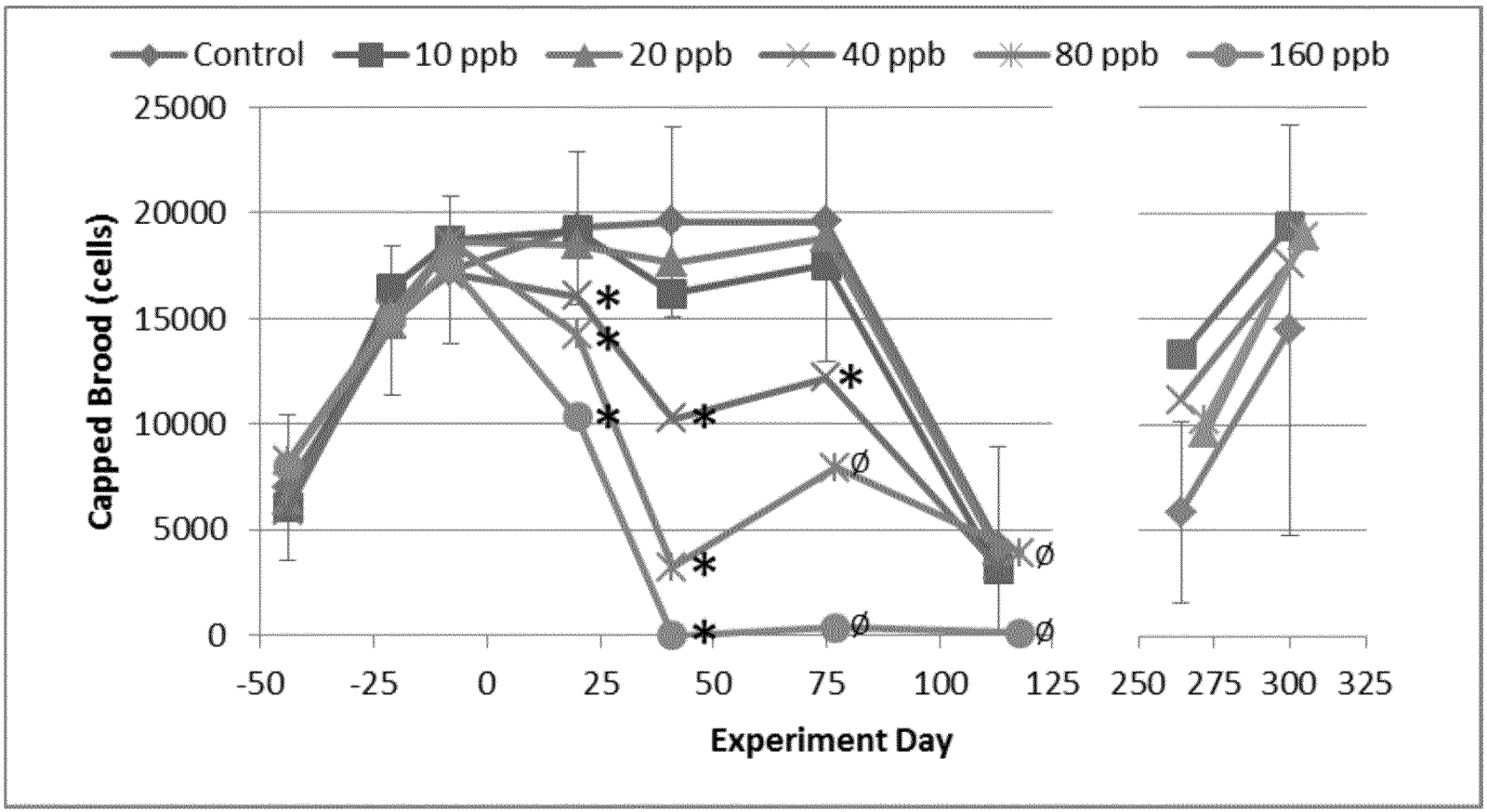
Capped Brood (Pupae)



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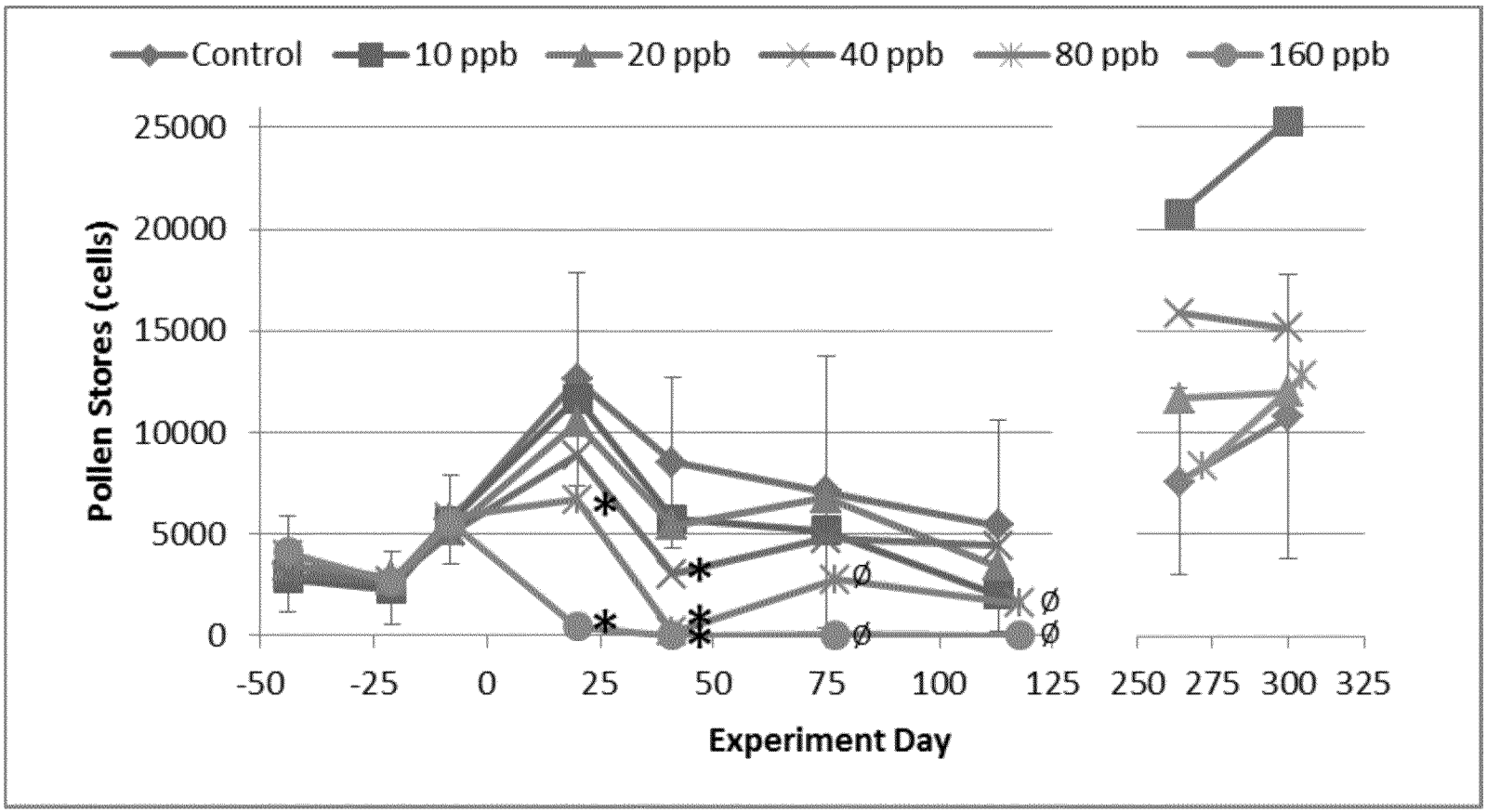
Pollen Stores (Beebread)



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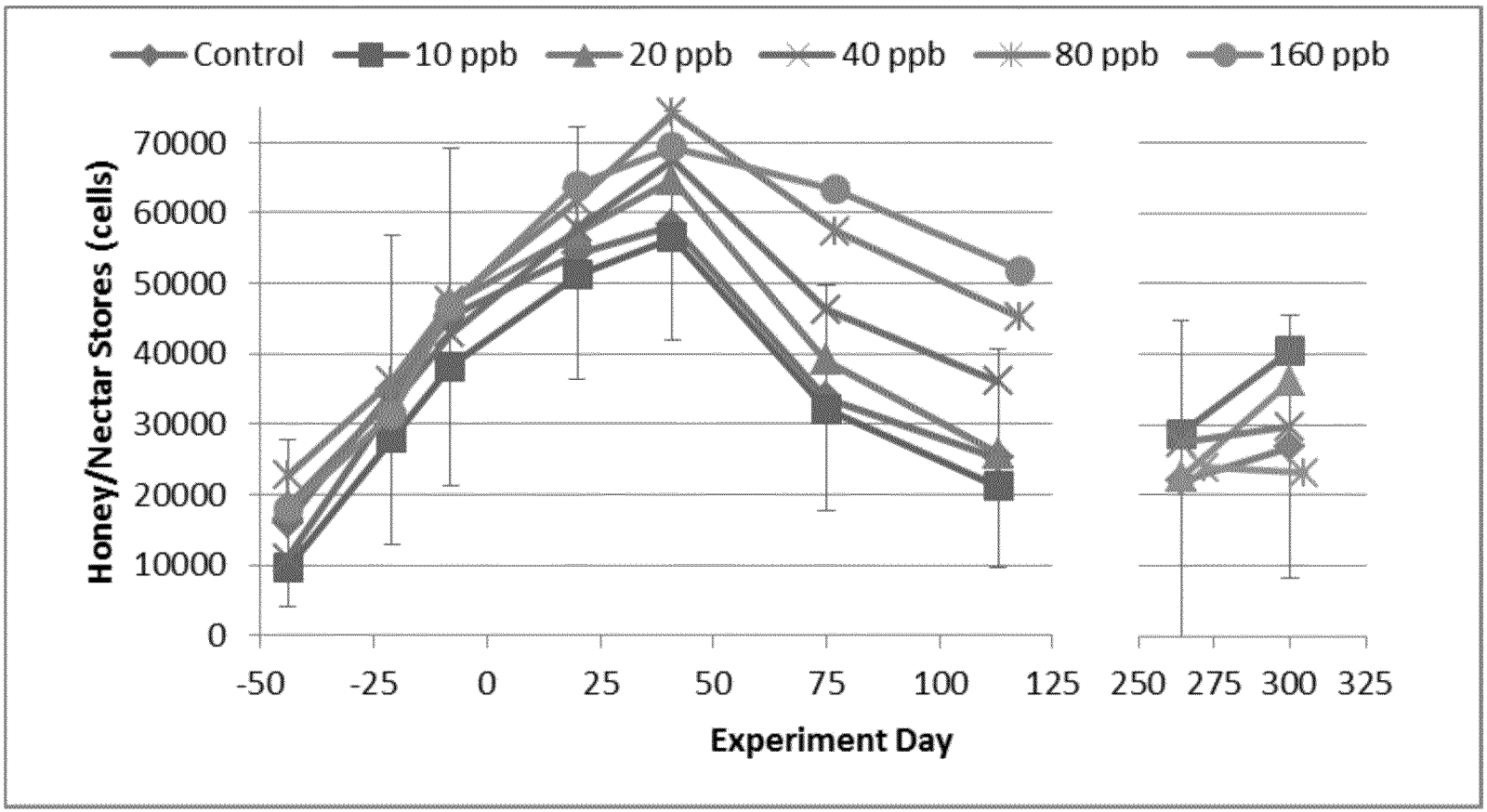
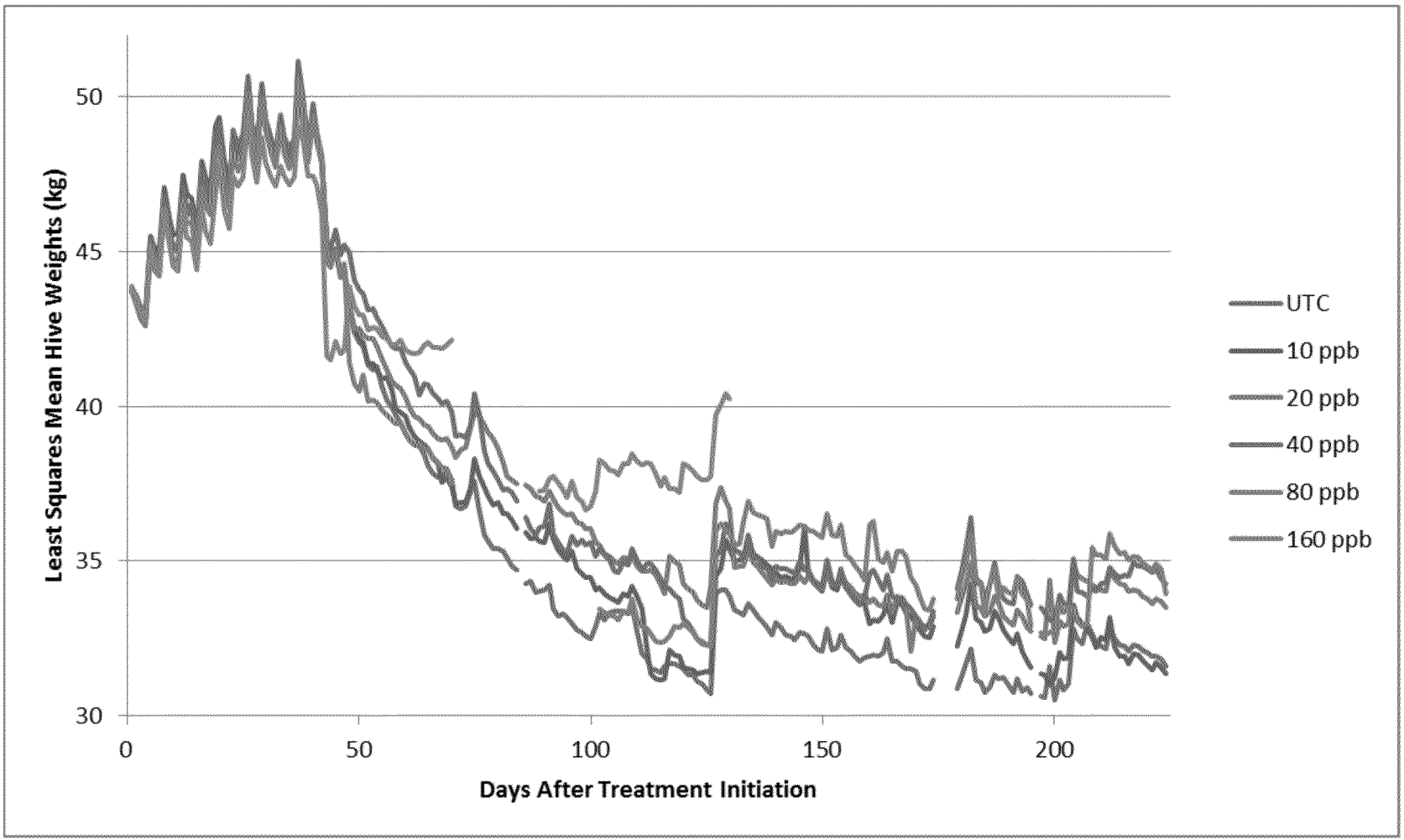
Honey/Nectar Stores



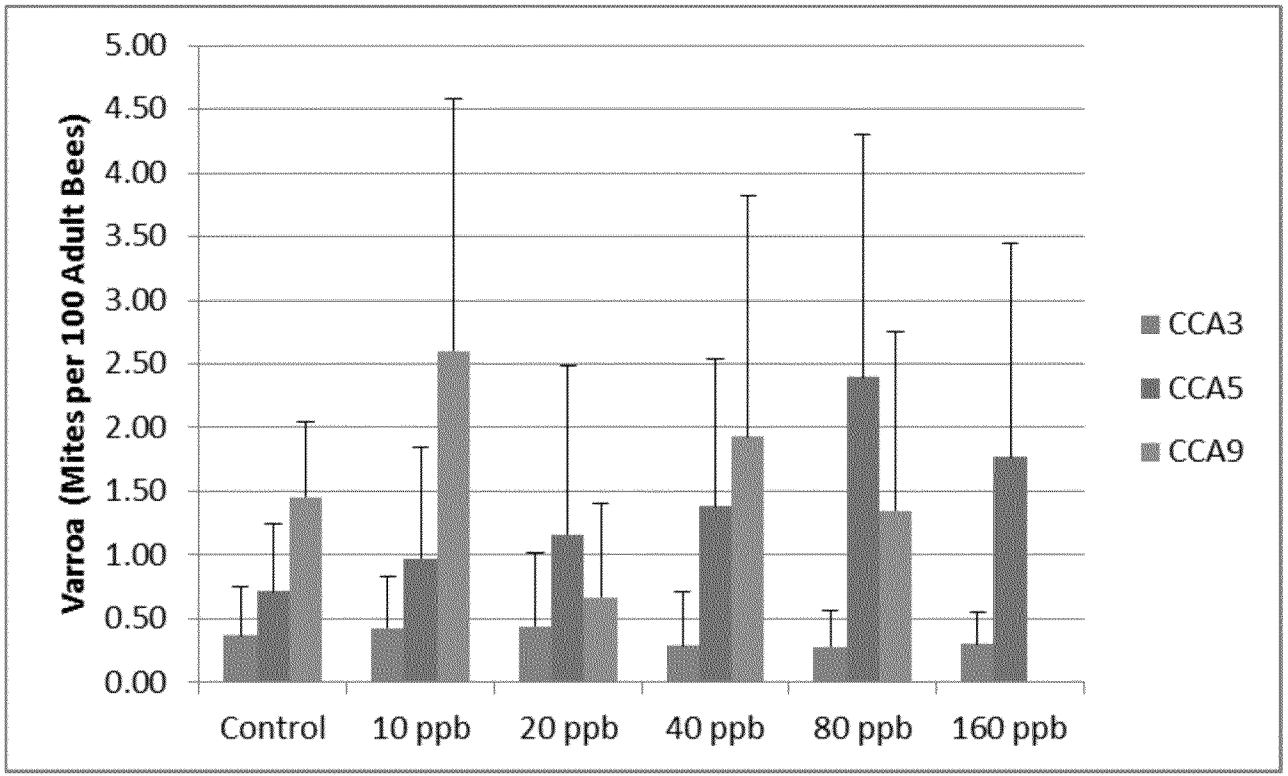
Hive Weights



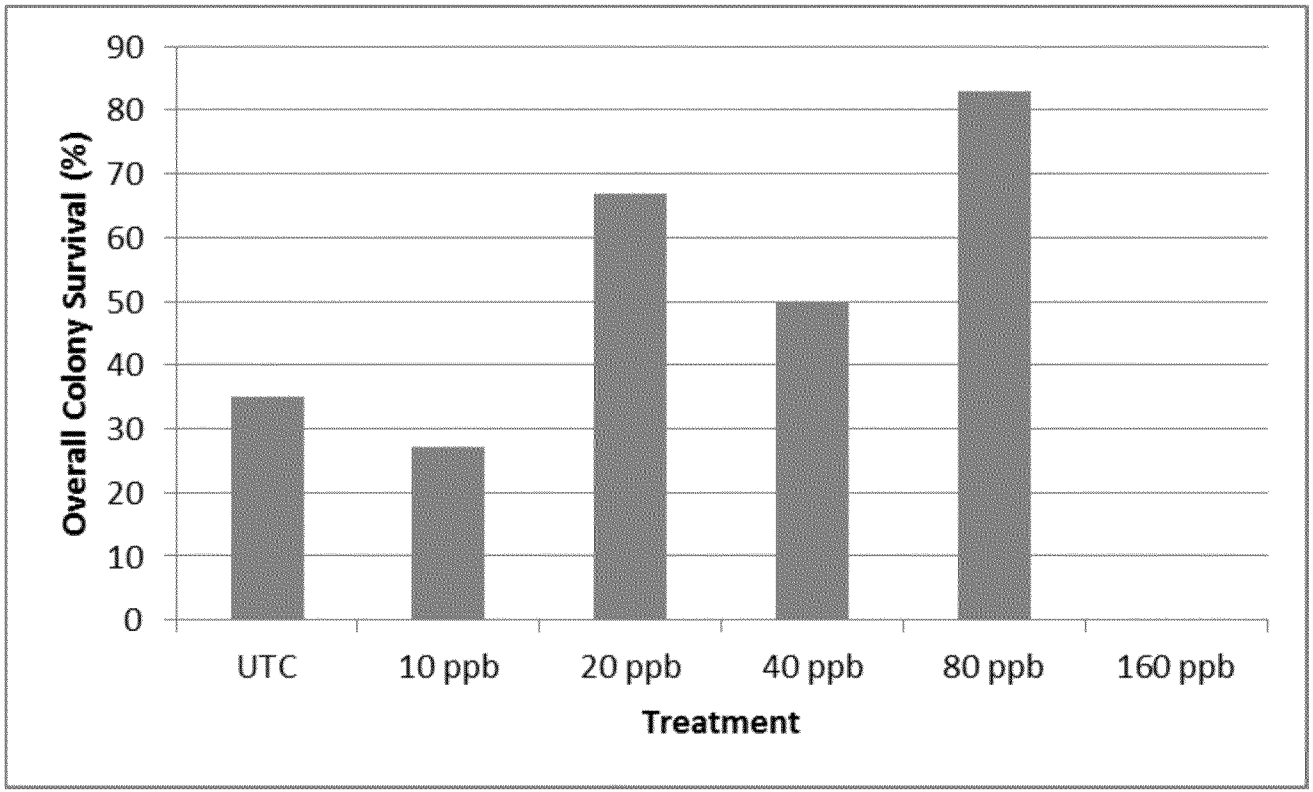
Median Clothianidin Residues (µg/kg)

Hive Matrix	Uncapped Nectar		Capped Honey		Beebread
Assessment	CCA4	CCA5	CCA7	CCA9	CCA5
Control	<LOD	<LOQ	<LOD	<LOD	<LOD
10 ppb	3.9	8.7	2.1	<LOQ	3.0
20 ppb	9.6	15.8	10.6	2.0	6.7
40 ppb	13.0	31.9	7.0	5.9	13.0
80 ppb	19.7	56.6	48.2	14.4	35.8
160 ppb	28.9	102.2	36.6	--	--

Varroa



Overall Colony Survival



All surviving colonies at the 160 ppb treatment level were destroyed before the overwintering period

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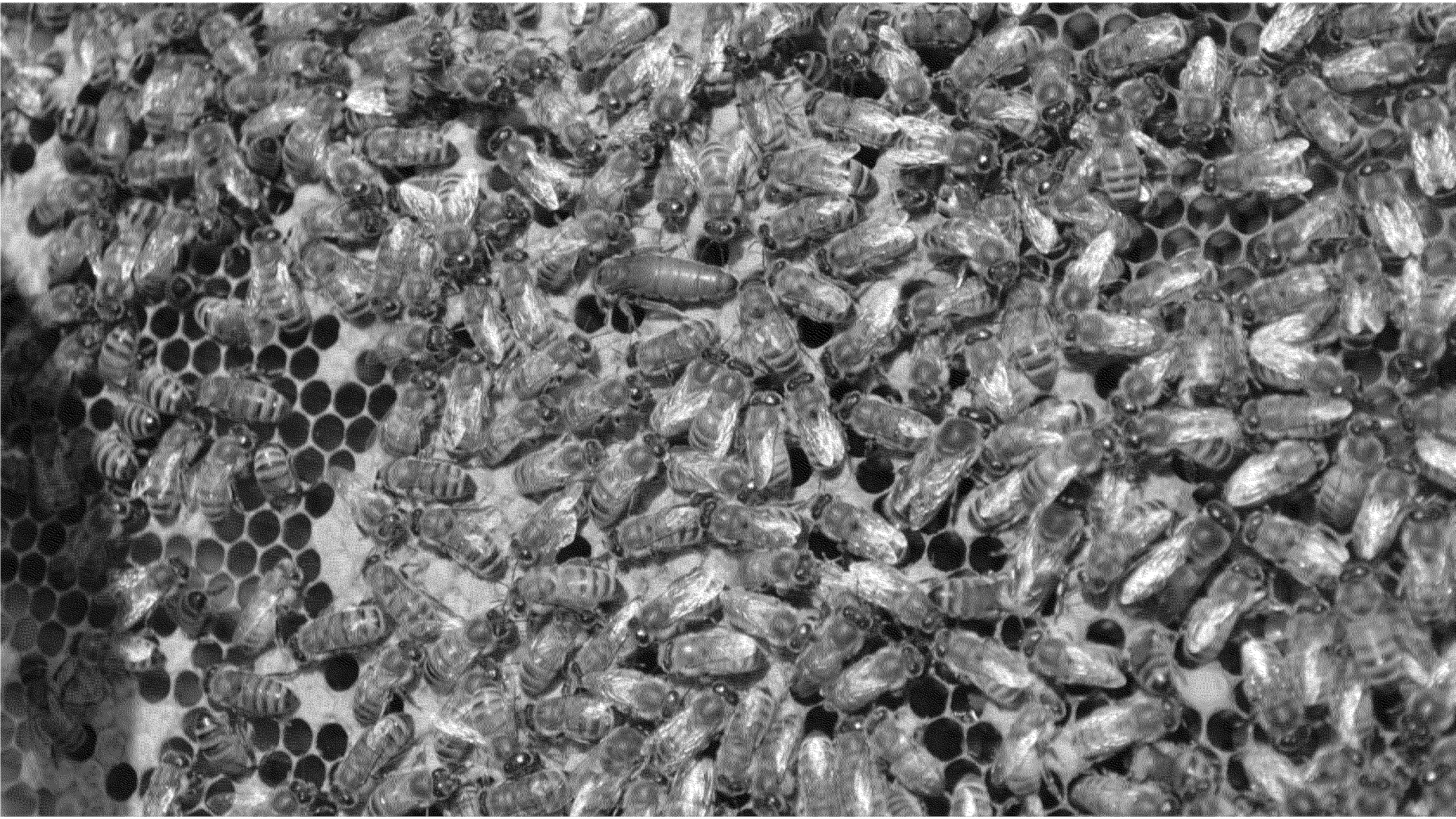
Questions?



Thank you for your attention!